Investment Decision

capital $\xrightarrow{10L}$ ₹ Financial manager company $\xrightarrow{Yes/No}$ Asset/ Project

"or"

which one to invest $\searrow$ 2 or more assets or projects

capital : 10,00,000
Cost : 100,000 (10%)

- Investment Decision
Or
- Capital Budgeting

Pay Back Period

1. It is a duration in which project will pay back its original investment.

2. Project with **lower** pay back period should be selected.

3. Formula:

Same Cash Flows:

- $\dfrac{\text{Initial Investment}}{\text{Annual CFAT}}$

Different Cash Flows.

Prepare cumulative CFAT column then solve.

CFAT: Cash Flow After Tax

4. **Example:**

Initial Investment = 9000 for each project.

Year	CFAT Project A	Project B
1	3000	3000
2	3000	2000
3	3000	2000
4	3000	4000
5	3000	5000

Calculate Pay-back Period.

Solution:

Project A

Initial Investment
————————————
Annual CFAT

$$\dfrac{9000}{3000}$$

3 years.

Project B

Year	CFAT	Cumulative CFAT
1	3000	3000
2	2000	5000
3	2000	7000
4	4000	11000
5	5000	16000

9000

7000 → 9000 → 2000

3 years + $\dfrac{2000}{4000}$

3 + 0.5

3.5 years

$\dfrac{4000}{2000} \times \dfrac{1}{?}$

CFAT (Cash Flow After Tax)

Particulars:		"OR"	
Sales	1200		1200
– variable Cost	(100)		(100)
– Cash Fixed cost	(100)		(100)
Earning before Depreciation & Tax	1000		1000
– Depreciation	(300)	Tax	(70)
Earning before Tax	700		930
– Tax (assume 10%)	(70)		
Earning After Tax	630		
+ Depreciation	300		
CFAT	930		

6min

QUESTION 1. (ILLUSTRATION 1)

ABC Ltd is evaluating the purchase of a new machinery with a depreciable base of ₹ 1,00,000; expected economic life of 4 years and change in earnings before taxes and depreciation of ₹ 45,000 in year 1, ₹ 30,000 in year 2, ₹ 25,000 in year 3 and ₹ 35,000 in year 4. Assume straight-line depreciation and a 20% tax rate. You are required to COMPUTE relevant cash flows.

(WN-1): Depreciation p.a.

$$\frac{100,000 - NIL}{4 \text{ years}} = 25000 \text{ p.a.}$$

1. Cash Flow After Tax:

Particulars	1	2	3	4
Earning before depreciation & Tax	45000	30,000	25000	35000
(–) Depreciation	(25000)	(25000)	(25000)	(25000)
Earning before Tax	20000	5000	–	10,000
– Tax (20%)	(4000)	(1000)	–	(2000)
Earning After Tax	16000	4000	–	8000
+ Depreciation	25000	25000	25000	25000
CFAT	41000	29000	25000	33000

Net Present Value (NPV)

QUESTION 3. (ILLUSTRATION 3)

COMPUTE the net present value for a project with a net investment of ₹ 1,00,000 and net cash flows for year one is ₹ 55,000; for year two is ₹ 80,000 and for year three is ₹ 15,000. Further, the company's cost of capital is 10%.
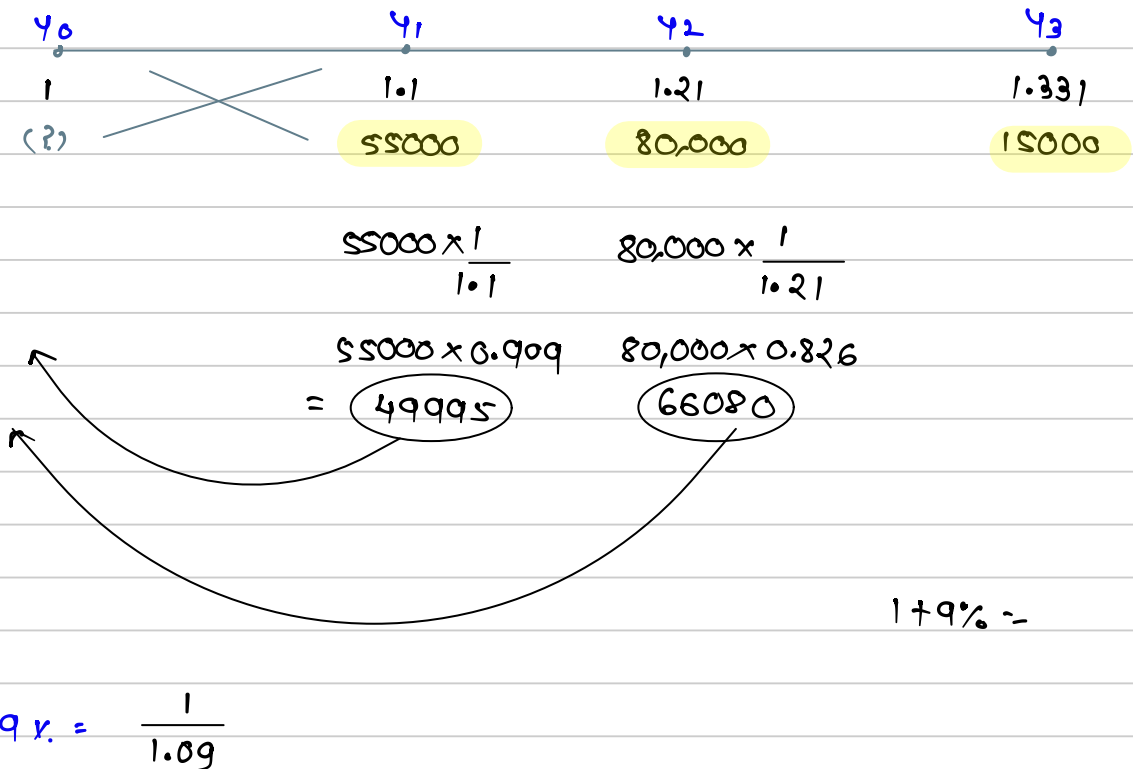[PVIF @ 10% for three years are 0.909, 0.826 and 0.751]

Solution:

Calculation of NPV:

$$\frac{1}{1.10} = = =$$

Year	Cash Flow	PVF @ 10%	PV
1	55000	0.909	49995
2	80,000	0.826	66080
3	15000	0.751	11265
	PV of Cash Inflows.		127340
	PV of Cash Outflows		(100,000)
	Net Present value		27340 .

Recommendation: Since NPV is positive.
          Company should accept the proposal.

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        Y0              Y1              Y2              Y3
        •               •               •               •
        1              1.1            1.21           1.331
       (?)            55000          80,000          15000
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$$55000 \times \frac{1}{1.1} \qquad 80,000 \times \frac{1}{1.21}$$

$$55000 \times 0.909 \qquad 80,000 \times 0.826$$

$$= \boxed{49995} \qquad \boxed{66080}$$

$$1 + 9\% : -$$

$$9 \text{ y.} = \frac{1}{1.09}$$

QUESTION 4. (ILLUSTRATION 4)

ABC Ltd. is a small company that is currently analyzing capital expenditure proposals for the purchase of equipment; the company uses the net present value technique to evaluate projects. The capital budget is limited to ₹ 500,000 which ABC Ltd. believes is the maximum capital it can raise. The initial investment and projected net cash flows for each project are shown below. The cost of capital of ABC Ltd is 12%. You are required to COMPUTE the NPV of the different projects.

	Project A (₹)	Project B (₹)	Project C (₹)	Project D (₹)
Initial Investment	200,000	190,000	250,000	210,000
Project Cash Inflows:				
Year 1	50,000	40,000	75,000	75,000
2	50,000	50,000	75,000	75,000
3	50,000	70,000	60,000	60,000
4	50,000	75,000	80,000	40,000
5	50,000	75,000	100,000	20,000

Solution:

Calculation of NPV.

		Projects			
Year	PVF@12%	A	B	C	D
1	0.893	44650	35720	66975	66975
2	0.797	39850	39850	59775	59775
3	0.712	35600	49840	42720	42720
4	0.636	31800	47700	50880	25440
5	0.567	28350	42525	56700	11340
PV OF CASH INFLOW		180250	215635	277050	206250
PV OF CASH OUTFLOW		(200,000)	(190,000)	(250,000)	(210,000)
NPV		(19750)	25635	27050	(3750)

Recommendation: Project A & D should be rejected.
Project B & C should be accepted.

Capital Budget	500,000
Investment in B	(190,000)
C	(250,000)
Surplus.	60,000

$$\frac{1}{1.12} = = = = =$$

18 min   Cello Limited is considering

QUESTION 24. (PP 5)

Cello Limited is considering buying a new machine which would have a useful economic life of five years, a cost of ₹ 1,25,000 and a scrap value of ₹ 30,000, with 80 per cent of the cost being payable at the start of the project and 20 per cent at the end of the first year. The machine would produce 50,000 units per annum of a new product with an estimated selling price of ₹ 3 per unit. Direct costs would be ₹ 1.75 per unit and annual fixed costs, including depreciation calculated on a straight- line basis, would be ₹ 40,000 per annum.

In the first year and the second year, special sales promotion expenditure, not included in the above costs, would be incurred, amounting to ₹ 10,000 and ₹ 15,000 respectively.

CALCULATE NPV of the project for investment appraisal, assuming that the company's cost of capital is 10 percent.

Solution:

(WN-1): Depreciation p.a.

$$\frac{125000 - 30,000}{5} = \frac{95000}{5} = 19000 \text{ p.a.}$$

(WN-2): Contribution p.a.: $(3 - 1.75) \times 50,000 = 62500$

(WN-3): Cash Fixed Cost: $40,000 - 19000 = 21000$

(WN-4): Net Cash Flows:

Year	Capital	Contribution	Fixed Cost	Advertisement	Total
0	(100,000)				(100,000)
1	(25000)	62500	(21000)	(10,000)	6500
2		62500	(21000)	(15000)	26500
3		62500	(21000)		41500
4		62500	(21000)		41500
5	30,000	62500	(21000)		71500

Calculation of NPV:

Year	Cash Flows	PVF @ 10%	PV
1	6500	0.909	5909
2	26500	0.826	21889
3	41500	0.751	31167
4	41500	0.683	28345
5	71500	0.621	44402
			131712
			(100,000)
		NPV:	31712

QUESTION 26. (PP 7)

Alley Pvt. Ltd. is planning to invest in a machinery that would cost ₹ 1,00,000 at the beginning of year 1. Net cash inflows from operations have been estimated at 36,000 per annum for 3 years. The company has two options for smooth functioning of the machinery – one is service, and another is replacement of parts. If the company opts to service a part of the machinery at the end of year 1 at ₹ 20,000, in such a case, the scrap value at the end of year 3 will be ₹ 25,000. However, if the company decides not to service the part, then it will have to be replaced at the end of year 2 at ₹ 30,800, and in this case, the machinery will work for the 4th year also and get operational cash inflow of ₹ 36,000 for the 4th year. It will have to be scrapped at the end of year 4 at ₹ 18,000.

Assuming cost of capital at 10% and ignoring taxes, DETERMINE the purchase of this machinery based on the net present value of its cash flows.

If the supplier gives a discount of ₹ 10,000 for purchase, what would be your decision?

Note: The PV factors at 10% are:

Year	0	1	2	3	4	5	6
PV Factor	1	0.9091	0.8264	0.7513	0.6830	0.6209	0.5645

Solution:

(WN-1) : Net Cash Flows :

	Option 1 service		
Year	Cash Flows		
1	36000 − 20,000	=	16000
2	36000	=	36000
3	36000 + 25000	=	61000

	Option 2 Replacement		
Year	Cash Flows		
1	36000	=	36000
2	36000 − 30800	=	5200
3	36000	=	36000
4	36000 + 18000	=	54000

2. Calculation of NPV :

Year	PVF @ 10%	Service PV	Replacement PV
1	0.9091	14546	32728
2	0.8264	29750	4297
3	0.7513	45829	27047
4	0.6830	–	36882
PV of Cash Inflows		90125	100954
PV of Cash Outflows		(100,000)	(100,000)
NPV		(9875)	954

- Since NPV is negative under option 1 (service).

  ∴ This option should not be accepted.

- Since NPV is positive under option 2 (Replacement)

  ∴ This option should be accepted.

2. NPV after Discount:

	Option 1 Service	Option 2 Replacement
NPV before discount	(9875)	954
+ Discount	+ 10,000	+10,000
NPV after discount	125	10954

Decision: Option II is worth investing as the net present value is positive and higher as compared to Option I.

QUESTION 21. (PP 2)

Lockwood Limited wants to replace its old machine with a new automatic machine. Two models A and B are available at the same cost of ₹ 5 lakhs each. Salvage value of the old machine is ₹ 1 lakh. The utilities of the existing machine can be used if the company purchases model A. Additional cost of utilities to be purchased in this case will be ₹ 1 lakh. If the company purchases B, then all the existing utilities will have to be replaced with new utilities costing ₹ 2 lakhs. The salvage value of the old utilities will be ₹ 0.20 lakhs. The cash flows are expected to be:

Year	Cash inflows of A (₹)	Cash inflows of B (₹)	P.V. Factor @ 15%
1	1,00,000	2,00,000	0.870
2	1,50,000	2,10,000	0.756
3	1,80,000	1,80,000	0.658
4	2,00,000	1,70,000	0.572
5	1,70,000	40,000	0.497
Salvage Value at the end of Year 5	50,000	60,000	

The targeted return on capital is 15%. You are required to (i) COMPUTE, for the two machines separately, net present value, discounted payback period and desirability factor and (ii) STATE which of the machines is to be selected?

Solution:

(WN-1): Net Cash Outflow: (At the Begining)

Particulars	Model A	Model B
Cost of machine	(500,000)	(500,000)
Salvage value of old machine	100,000	100,000
Cost of utilities	(100,000)	(200,000)
Salvage value of old utilities	–	20,000
	(500,000)	(580,000)

1. Calculation of NPV: (Higher is better)

		machine A		machine B	
Years	PVF @ 15%	Cash Flow	PV	Cash Flow	PV
1	0.870	100,000	87000	200,000	174000
2	0.756	150,000	113400	210,000	158760
3	0.658	180,000	118440	180,000	118440
4	0.572	200,000	114400	170,000	97240
5	0.497	220,000	109340	100,000	49700
		(170,000 + 50,000)		(40,000 + 60,000)	
PV of cash Inflow			542580		598140
PV of cash Outflow			(500,000)		(580,000)
NPV			42580		18140

2. Discounted Pay Back Period: (lower is better)

Machine A

Year	CFAT	Cumulative CFAT
1	87000	87000
2	113400	200400
3	118440	318840
4	114400	433240
5	109340	542580

Machine B

Year	CFAT	Cumulative CFAT
1	174000	174000
2	158760	332760
3	118440	451200
4	97240	548440
5	49700	598140

$$\text{Machine A} = 4 \text{ years} + \frac{66760}{109340} \qquad (433240 \leftarrow 500,000)$$

$$= 4.61 \text{ years}$$

$$\text{Machine B} = 4 \text{ years} + \frac{31560}{49700} \qquad (548440 \leftarrow 580,000 \rightarrow)$$

$$= 4.64 \text{ years}$$

3. Desirability Factor / Profitability Index: (Higher is better)

$$\text{Profitability Index} = \frac{PV \text{ of Cash Inflows}}{PV \text{ of Cash Outflows}} \qquad \frac{150}{100} = 1.5 \qquad \frac{120}{100} = 1.2$$

Machine A

$$\frac{542580}{500,000}$$

$$1.09$$

Machine B

$$\frac{598140}{580,000}$$

$$1.03$$

Extra: If profitability index is

			Project
less than 1	:	NP is negative	: Rejected
1	:	NPV = zero	: Indifferent.
more than 1	:	NPV is positive	: Accepted

a) From NPV point of view, machine A is preferred because it has higher NPV.

b) From Discounted PBP point of view, machine A is preferred because it has lower PBP

c) From Desirability Factor point of view, machine A is preferred because it has highest derisability factor.

Therefore, overall basis machine A is preferred.

QUESTION 27. (PP 8)

NavJeevani hospital is considering to purchase a machine for medical projectional radiography which is priced at ₹ 2,00,000. The projected life of the machine is 8 years and has an expected salvage value of ₹ 18,000 at the end of 8th year. The annual operating cost of the machine is ₹ 22,500. It is expected to generate revenues of ₹ 1,20,000 per year for eight years. Presently, the hospital is outsourcing the radiography work to its neighbour Test Center and is earning commission income of ₹ 36,000 per annum, net of taxes.

Required:

ANALYSE whether it would be profitable for the hospital to purchase the machine. Give your recommendation under:

(i)   Net Present Value method

(ii)   Profitability Index method

Consider tax @30%. PV factors at 10% are given below:

Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
0.909	0.826	0.751	0.683	0.621	0.564	0.513	0.467

Solution:

(WN-1): CFAT p.a.

Sales	1,20,000
− Operating cost	(22,500)
	97,500
− Depreciation $\left(\dfrac{2,00,000 - 18,000}{8}\right)$	(22,750)
EBT	74,750
− Tax @ 30%	(22,425)
EAT	52,325
+ Depreciation	22,750
	75,075
− Loss of Commission	36,000
	39,075

1. Calculation of NPV

Year	Cash Flow	PVF @ 10%	PV
1-7	39,075	4.867	1,90,178
8	57,075 (39,075 + 18,000)	0.467	26,654
	PV of Cash Inflow		2,16,832
	PV of Cash Outflow		(2,00,000)
	NPV		**16,832**

2. Profitability Index:

$$\dfrac{PV \ of \ Cash \ Inflows}{PV \ of \ Cash \ Outflows}$$

$$\dfrac{2,16,832}{2,00,000}$$

1.08

Since NPV is positive & profitability index is more than 1.
Hospital should purchase the machine.

QUESTION 28. (PP 9)

XYZ Ltd. is planning to introduce a new product with a project life of 8 years. Initial equipment cost will be ₹ 3.5 crores. Additional equipment costing ₹ 25,00,000 will be purchased at the end of the third year from the cash inflow of this year. At the end of 8 years, the original equipment will have no resale value, but additional equipment can be sold for ₹ 2,50,000. A working capital of ₹ 40,00,000 will be needed and it will be released at the end of eighth year. The project will be financed with sufficient amount of equity capital.

The sales volumes over eight years have been estimated as follows:

The sales volumes over eight years have been estimated as follows:

Year	1	2	3	4 – 5	6 – 8
Units per year	72,000	1,08,000	2,60,000	2,70,000	1,80,000

A sales price of ₹ 240 per unit is expected and variable expenses will amount to 60% of sales revenue. Fixed cash operating costs will amount ₹ 36,00,000 per year. The loss of any year will be set off from the profits of subsequent two years. The company is subject to 30 per cent tax rate and considers 12 per cent to be an appropriate after-tax cost of capital for this project. The company follows straight line method of depreciation.
CALCULATE the net present value of the project and advise the management to take appropriate decision.

The PV factors at 12% are

Year	1	2	3	4	5	6	7	8
PV Factor	0.893	0.797	0.712	0.636	0.567	0.507	0.452	0.404

Extra:

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  0    1    2    3    4    5    6    7    8
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machine: (350)   NIL
Equipment: (25) ✔   ✔ 2.5
WC   (40)   ✔ 40

(WN-1) : Deprecation :

a) From Year 1 to 3 :

$$\frac{350-0}{8} = 43.75$$

b) From Year 4 to 8 :

$$\left(\frac{25-2.5}{5}\right) + 43.75 = 48.25$$

(WN-2) : CFAT p.a. (₹ in lakhs)

Particulars \ Years	1	2	3	4-5	6-8
Sales (240 × Qty sold)	172.8	259.2	624	648	432
- VC (Sales × 60%)	103.68	155.52	374.4	388.8	259.2
- Cash FC	36	36	36	36	36
- Depreciation	43.75	43.75	43.75	48.25	48.25
EBT	(10.63)	23.93	169.85	174.95	88.55
- Tax	-	(3.99)	(50.955)	(52.485)	(26.565)
EAT	(10.63)	19.94	118.895	122.465	61.985
+ Depreciation	43.75	43.75	43.75	48.25	48.25
CFAT	33.12	63.69	162.645	170.715	110.235

(WN-3) : Tax in Year 2:   23.93 - 10.63 = 13.3 × 30% = 3.99

1. Calculation of NPV :

Years	Cash Flows	PVF @ 12%	PV
1	33.12	0.893	29.58
2	63.69	0.797	50.76
3	137.645	0.712	98.00
	(162.645 - 25)		
4	170.715	0.636	108.57
5	170.715	0.567	96.80
6	110.235	0.507	55.89
7	110.235	0.452	49.83
8	152.735	0.404	61.70
	(110.235 + 2.5 + 40)		

PV of Cash Inflow		551.13
PV of Cash Outflow		(390)
(350 + 40)		
NPV		161.13

Advise: Since the project has a positive NPV, therefore, it should be accepted

7 min   Suppose we have three projects involving

QUESTION 5. (ILLUSTRATION 5)

Suppose we have three projects involving discounted cash outflow of ₹ 5,50,000, ₹ 75,000 and ₹ 1,00,20,000 respectively. Suppose further that the sum of discounted cash inflows for these projects are ₹ 6,50,000, ₹ 95,000 and ₹ 1,00,30,000 respectively. CALCULATE the desirability factors for the three projects.

Solution:

$$\text{Desirability Factor} = \frac{\text{PV of Cash Inflow}}{\text{PV of Cash Outflows}}$$

Project 1	Project 2	Project 3
$\frac{650,000}{550,000}$	$\frac{95000}{75000}$	$\frac{10030,000}{10020,000}$
1.18	1.27	1.001

17 min   A chemical company is presently paying an outside

QUESTION 32. (PP 13)

A chemical company is presently paying an outside firm ₹ 1 per gallon to dispose off the waste resulting from its manufacturing operations. At normal operating capacity, the waste is about 50,000 gallons per year.

After spending ₹ 60,000 on research, the company discovered that the waste could be sold for ₹ 10 per gallon if it was processed further. Additional processing would, however, require an investment of ₹ 6,00,000 in new equipment, which would have an estimated life of 10 years with no salvage value. Depreciation would be calculated by straight line method.

Except for the costs incurred in advertising ₹ 20,000 per year, no change in the present selling and administrative expenses is expected, if the new product is sold. The details of additional processing costs are as follows:

Variable   :   ₹ 5 per gallon of waste put into process.
Fixed   :   Excluding Depreciation) ₹ 30,000 per year.

There will be no losses in processing, and it is assumed that the total waste processed in a given year will be sold in the same year. Estimates indicate that 50,000 gallons of the product could be sold each year.

The management when confronted with the choice of disposing off the waste or processing it further and selling it, seeks your ADVICE. Which alternative would you recommend? Assume that the firm's cost of capital is 15% and it pays on an average 50% Tax on its income.

You should consider Present value of Annuity of ₹ 1 per year @ 15% p.a. for 10 years as 5.019.

(WN-1): CFAT p.a. :   (Incremental)

Sales	(50,000 ×10)	500,000
COST:		
Variable	(50,000 × 5)	250,000
Cash Fixed Cost		30,000
Depreciation	$\left(\dfrac{600,000 - 0}{10}\right)$	60,000
Advertisement		20,000
		140,000
+ Saving in wastage cost (50,000×1)		50,000 *
EBT		190,000
− Tax @ 50%		(95000)
EAT		95000
+ Depreciation		60,000
		155000

Calculation of NPV:

PV of Cash Inflow: (155000 × 5.019)	777945
PV of Cash outflow:	(600,000)
NPV	177945

Decision:

Since NPV is positive processing of waste is better option.

40 min   Manoranjan Ltd is a News broadcasting

QUESTION 33. (PP 14)

Manoranjan Ltd is a News broadcasting channel having its broadcasting Centre in Mumbai. There are total 200 employees in the organisation including top management. As a part of employee benefit expenses, the company serves tea or coffee to its employees, which is outsourced from a third-party. The company offers tea or coffee three times a day to each of its employees. 120 employees prefer tea all three times, 40 employees prefer coffee all three times and remaining prefer tea only once in a day. The third-party charges ₹ 10 for each cup of tea and ₹ 15 for each cup of coffee. The company works for 200 days in a year.

Looking at the substantial amount of expenditure on tea and coffee, the finance department has proposed to the management an installation of a master tea and coffee vending machine which will cost ₹ 10,00,000 with a useful life of five years. Upon purchasing the machine, the company will have to enter into an annual maintenance contract with the vendor, which will require a payment of ₹ 75,000 every year. The machine would require electricity consumption of 500 units p.m. and current incremental cost of electricity for the company is ₹ 12 per unit. Apart from these running costs, the company will have to incur the following consumables expenditure also:

(1)   Packets of Coffee beans at a cost of ₹ 90 per packet.
(2)   Packet of tea powder at a cost of ₹ 70 per packet.
(3)   Sugar at a cost of ₹ 50 per Kg.
(4)   Milk at a cost of ₹ 50 per litre.
(5)   Paper cup at a cost of 20 paise per cup.

Each packet of coffee beans would produce 200 cups of coffee and same goes for tea powder packet. Each cup of tea or coffee would consist of 10g of sugar on an average and 100 ml of milk.

The company anticipate that due to ready availability of tea and coffee through vending machines its employees would end up consuming more tea and coffee.

 It estimates that the consumption will increase by on an average 20% for all class of employees. Also, the paper cups consumption will be 10% more than the actual cups served due to leakages in them.

The company is in the 25% tax bracket and has a current cost of capital at 12% per annum. Straight line method of depreciation is allowed for the purpose of taxation. You as a financial consultant is required to ADVISE on the feasibility of acquiring the vending machine.

PV factors @ 12%:

Year	1	2	3	4	5
PVF	0.8929	0.7972	0.7118	0.6355	0.5674

(WN-1) : NO OF Tea & Coffee cups:

200 Employees

Tea	Coffee	Tea
120	40	40
× 3	× 3	× 1
× 200	× 200	× 200
72000	24000	8000

∴ Total Tea cups = 72000 + 8000 = 80,000   Total Coffee cups = 24000

(WN-2): CFAT (p.a):

A) Saving in Cost: 1160,000

$$\left(\begin{array}{l} \text{Tea}: \ 80,000 \times 10 = 800,000 \\ \text{Coffee}: \ 24000 \times 15 = 360,000 \\ \hline \qquad\qquad\qquad\qquad 1160,000 \end{array}\right)$$

B) Cost:

i) AMC of machine	75000
ii) Electricity (500 units × 12 months × Rs.12)	72000
iii) Coffee Beans $\left(\dfrac{24000 + 20\%}{200} \times 90\right)$	12960

"OR"

$$\left(\begin{array}{ccc} 200 \text{ cups} & & 1 \text{ packet} \\ 28800 \text{ cups} & \times & (?) \\ (24000+20\%) & & \times 90 \end{array}\right)$$

iv) Tea Power	33600

$$\left(\begin{array}{ccc} 200 \text{ cups} & & 1 \text{ packet} \\ 96000 \text{ cups} & \times & (?) \\ (80,000+20\%) & & \times 70 \end{array}\right)$$

v) Sugar $\left(\dfrac{[(80,000+24000)+20\%] \times 10\text{ grams}}{1000\text{ grams}} \times 50\right)$	62400
vi) Milk $\left(\dfrac{[(80,000+24000)+20\%] \times 100\text{ ml}}{1000\text{ ml}} \times 50\right)$	624000
vii) Paper cup: $\{[(80,000+24000)+20\%]+10\%\} \times 0.20$	27456
viii) Depreciation (10,00,000 ÷ 5)	200,000
PBT	52584
− Tax @25%	(13146)
	39438
+ Depreciation	200,000
	239438

1. Calculation of NPV

PV of Cash Inflow (239438 × 3.6048)	863126
PV of Cash Outflow	(10,00,000)
NPV	(136874)

Since NPV is negative.
Vending machine should not be purchased.

20 min   Elite Cooker Company is evaluating three investment

QUESTION 23. (PP 4)

Elite Cooker Company is evaluating three investment situations: (1) Produce a new line of aluminium skillets, (2) Expand its existing cooker line to include several new sizes, and (3) Develop a new, higher-quality line of cookers. If only the project in question is undertaken, the expected present values and the amounts of investment required are:

Project	Investment required ₹	Present value of Future Cash-Flows ₹
1	2,00,000	2,90,000
2	1,15,000	1,85,000
3	2,70,000	4,00,000

If projects 1 and 2 are jointly undertaken, there will be no economies; the investments required and present values will simply be the sum of the parts. With projects 1 and 3, economies are possible in investment because one of the machines acquired can be used in both production processes. The total investment required for projects 1 and 3 combined is ₹ 4,40,000. If projects 2 and 3 are undertaken, there are economies to be achieved in marketing and producing the products but not in investment. The expected present value of future cash flows for projects 2 and 3 is ₹ 6,20,000. If all three projects are undertaken simultaneously, the economies noted will still hold. However, a ₹ 1,25,000 extension on the plant will be necessary, as space is not available for all three projects. CALCULATE NPV of the projects and STATE which project or projects should be chosen?

Calculation of NPV :

Project	PV of Cash Inflow	PV of Cash Outflow	NPV
1	290,000	200,000	90,000
2	185000	115000	70,000
3	400,000	270,000	130,000
1 & 2	475000	315000	160,000
1 & 3	690,000	440,000 *	250,000
2 & 3	* 620,000	385000	235000
1, 2 & 3	910,000	680,000	230,000

(WN-1) : PV of Cash outflow (1,2 & 3)

Project 1 & 3	440,000
Project 2	115000
Plant Extension	125000
	680,000

(WN-2): PV of Cash Inflow (1,2 & 3)

Project 2 & 3	620,000
Project 1	290,000
	910,000

Since NPV is highest in Project 1 & 3.

Therefore Project 1 & 3 should be accepted.

Ae Bee Cee Ltd. is planning to invest in

QUESTION 25. (PP 6)

Ae Bee Cee Ltd. is planning to invest in machinery, for which it has to make a choice between the two identical machines, in terms of Capacity, 'X' and 'Y'. Despite being designed differently, both machines do the same job. Further, details regarding both the machines are given below:

Particulars	Machine 'X'	Machine 'Y'
Purchase Cost of the Machine (₹)	15,00,000	10,00,000
Life (years)	3	2
Running cost per year (₹)	4,00,000	6,00,000

The opportunity cost of capital is 9%.
You are required to IDENTIFY the machine which the company should buy?

The present value (PV) factors at 9% are:

Year	t_1	t_2	t_3
$PVIF_{0.09.t}$	0.917	0.842	0.772

1. Present value of Outflow:

a) machine x :

Year	cash flow	PVF @9%	PV
0	1500,000	1	1500,000
1	400,000	0.917	366800
2	400,000	0.842	336800
3	400,000	0.772	308800
			2512400
			÷ 2.531
			992651

FV X PVF = PV p.a

PV
÷ PVF
FV p.a.

b) machine y :

Year	cash flow	PVF @9%	PV
0	10,00,000	1	10,00,000
1	600,000	0.917	550200
2	600,000	0.842	505200
			2055400
			÷ 1.759
			1168505

Decision: company should buy machine x because equivalent cash outflow p.a. is lower as compared to machine y.

QUESTION 10. (ILLUSTRATION 10)

Suppose there are two Project A and Project B are under consideration. The cash flows associated with these projects are as follows:

Year	Project A (₹)	Project B (₹)
0	(1,00,000)	(3,00,000)
1	50,000	1,40,000
2	60,000	1,90,000
3	40,000	1,00,000

Assuming Cost of Capital equal to 10%, IDENTIFY which project should be accepted as per NPV Method and IRR Method.

1. Calculation of NPV :

Year	PVF@10%	Project A PV	Project B PV
1	0.909	45450	127260
2	0.826	49560	156940
3	0.751	30040	75100
PV of cash Inflow		125050	359300
PV of cash outflow		(100,000)	(300,000)
NPV		25050	59300

2. Calculation of IRR (Internal rate of return)

Let's calculate NPV at 25%

Year	PVF@25%	Project A PV	Project B PV
1	0.8	40000	112000
2	0.64	38400	121600
3	0.512	20480	51200
PV of cash Inflow		98880	284800
PV of cash outflow		(100,000)	(300,000)
NPV		(1120)	(15200)

$$IRR = \text{lower \% Base} + \frac{\text{Positive NPV}}{\Delta \text{ in NPV}} \times \Delta \text{ in \%}$$

Project A:

$$10 + \frac{25050}{25050 + 1120} \times (25-10)$$

= **24.36%**   (26170)

Project B

$$10 + \frac{59300}{59300 + 15200} \times (25-10)$$

(74500)

= **21.94**

from NPV point of view, project B is better as it has higher NPV

from IRR point of view, project A is better as it has higher IRR.

Thus, there is contradiction in ranking by two methods

Extra:

Project A:

+ Δ 15%

IRR "?"

% : 10%   25%

NPV : 25050   0   (1120)

—25050

− Δ 26170

$$10 + \left(\frac{26170}{25050} \times 15 \right)$$

$$10 + \frac{25050}{26170} \times 15$$

$$10 + 14.36$$

24.36

+ 10%   ? 3.47

10%   20%   ?

25050   6450   0

− 18600   6450

20 + 3.47

23.47

QUESTION 11. (ILLUSTRATION 11)

Suppose ABC Ltd. is considering two Project X and Project Y for investment. The cash flows associated with these projects are as follows:

Year	Project X (₹)	Project Y (₹)
0	(2,50,000)	(3,00,000)
1	2,00,000	50,000
2	1,00,000	1,00,000
3	50,000	3,00,000

Assuming Cost of Capital be 10%, IDENTIFY which project should be accepted as per NPV Method and IRR Method.

1. Calculation of NPV :

		Project X	Project Y
Year	PVF @ 10%	PV	PV
1	0.909	181800	45450
2	0.826	82600	82600
3	0.751	37550	225300
		301950	353350
		(250,000)	(300,000)
		51950	53350

IRR =

$$\text{lower \%} + \frac{\text{Positive NPV}}{\Delta \text{ in NPV}} \times \Delta \text{ in \%}$$

Project X

$$10 + \frac{51950}{52350} \times (25-10)$$

24.89 %

2. Calculation of IRR :

		Project X	Project Y
Year	PVF @ 25%	PV	PV
1	0.8	160,000	40,000
2	0.64	64000	64000
3	0.512	25600	153600
		249600	257600
		(250,000)	(300,000)
		(400)	(42400)

Project Y

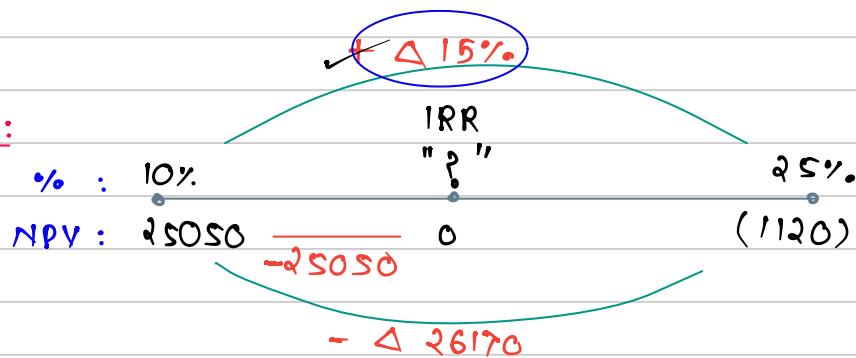$$10 + \frac{53350}{95750} \times (25-10)$$

18.36 %

From NPV point of view, project y is better as it has higher NPV

From IRR point of view, project x is better as it has higher IRR.
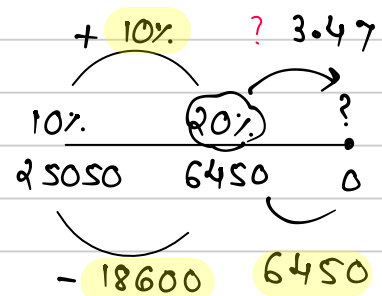
Thus, there is contradiction in ranking by two methods

QUESTION 12. (ILLUSTRATION 12)

Suppose MVA Ltd. is considering two Project A and Project B for investment. The cash flows associated with these projects are as follows:

Year	Project A (₹)	Project B (₹)
0	(5,00,000)	(5,00,000)
1	7,50,000	2,00,000
2	0	2,00,000
3	0	7,00,000

Assuming Cost of Capital be ~~10%~~ 12%, IDENTIFY which project should be accepted as per NPV Method and IRR Method.

1. NPV.

		Project A		Project B	
year.	PVF @12%	CFAT	PV	CFAT	PV
0	1	(500,000)	(500,000)	(500,000)	(500,000)
1	0.893	750,000	669750	200,000	178600
2	0.797	-		200,000	159400
3	0.712	-		700,000	498400
			169750		336400

2. IRR:

		Project A		Project B	
year.	PVF @ 50%	CFAT	PV	CFAT	PV
0	1	(500,000)	(500,000)	(500,000)	(500,000)
1	0.667	750,000	500250	200,000	133400
2	0.444	-		200,000	88800
3	0.296	-		700,000	207200
			250		(70600)

↓

since NPV
is very small
IRR = 50%.

IRR for Project B: $12 + \dfrac{336400}{336400 - (70600)} \times (50-12)$

$12 + \dfrac{336400}{407000} \times 38$

$12 + 31.41$

43.41%

Table:	Project A	Project B
NPV	169750	336400
IRR	50%	43.41%

As per NPV = Project B is better
As per IRR = Project A is better.

Thus, there is contradiction in ranking
By two methods.

1. Pay-back Period:

Year	CFAT	Cumulative CFAT
1-5	70,00,000	70,00,000
	(14L × 5years)	
6	1600,000	8600,000

$$\left(\frac{1600,000}{1000,000} \times \frac{1}{?} \right)$$

```
                    80,00,000
            ↓
    70,00,000              Balance
      ↓                      ↓
```
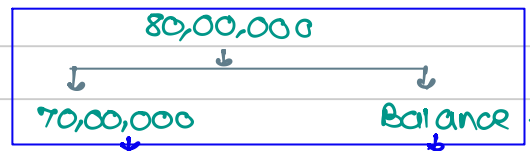
$$= \quad 5 \text{ years} + \frac{10,00,000}{1600,000}$$

$$= \quad 5.625 \text{ years} \quad \text{or}$$

$$5 \text{ years} \& 7.5 \text{ months} \ (0.625 \times 12)$$

2. NPV at 10% Discount Factor

Year	Cash Flow	PVF @ 10%	PV
1-5	1400,000	3.79	5306000
6	1600,000	0.564	902400
7	20,00,000	0.513	1026000
8	30,00,000	0.467	1401000
9	20,00,000	0.424	848000
10	8,00,000	0.386	308800
PV of cash Inflow			9792200
PV of cash outflow			(80,00,000)
NPV.			1792200

3. Profitability Index:

$$\frac{PV \text{ of Cash Inflow}}{PV \text{ of Cash Outflow}} = \frac{9792200}{80,00,000} = 1.224$$

4. Internal Rate of Return:

Year	cash flow	PVF@15%	PV
1-5	14,00,000	3.353	4694200
6	1600,000	0.432	691200
7	20,00,000	0.376	752000
8	30,00,000	0.327	981000
9	20,00,000	0.284	568000
10	8,00,000	0.247	197600

PV of cash Inflow		7884000
PV of cash outflow		(80,00,000)
NPV		(116000)

$$IRR = lower\% + \frac{Positive\ NPV}{\Delta\ in\ NPV} \times \Delta\ in\ Rate$$

$$= 10 + \frac{1792200}{1792200 + 116000} \times (15-10)$$

$$= \boxed{14.70\%}$$

43 min   Xavly Ltd. has a machine which has

QUESTION 30. (PP 11)

Xavly Ltd. has a machine which has been in operation for 3 years. The machine has a remaining estimated useful life of 5 years with no salvage value in the end. Its current market value is ₹ 2,00,000. The company is considering a proposal to purchase a new model of machine to replace the existing machine. The relevant information is as follows:

	Existing Machine	New Machine
Cost of machine	₹ 3,30,000	₹ 10,00,000
Estimated life	8 years	5 years
Salvage value	Nil	₹ 40,000
Annual output	30,000 units	75,000 units
Selling price per unit	₹ 15	₹ 15
Annual operating hours	3,000	3,000
Material cost per unit	₹ 4	₹ 4
Labour cost per hour	₹ 40	₹ 70
Indirect cash cost per annum	₹ 50,000	₹ 65,000

The company uses written down value of depreciation @ 20% and it has several other machines in the block of assets. The Income tax rate is 30 per cent and Xavly Ltd. does not make any investment, if it yields less than 12 per cent.

(WN-1): Cash outflow at the begining :

Cost of new machine	10,00,000
– scrap value of existing machine	(200,000)
	800,000

(WN-2): Profit before Depreciation & Tax:

Particulars	Existing machine	New machine	Incremental
Qty (units)	30,000	75000	
A) Sales (15)	450,000	1125000	675000
B) COST:			
material (4)	120,000	300,000	180,000
Labour	120,000	210,000	90,000
	(3000 × 40)	(3000 × 70)	
Indirect cost	50,000	65000	15000
C) Earning before Depreciation & Tax	160,000	550,000	390,000 .

(WN-3) : Base for Incremental Depreciation:

Particulars	Amt
a) WDV of existing machinery: (@ 20% WDV)	
Cost of machine	330,000
– Depreciation (Year 1)	(66000)
	264000
– Depreciation (Year 2)	(52800)
	211200
– Depreciation (Year 3)	(42240)
a)	168960
b) Depreciation base for new machinery:	
Opening WDV	168960
+ Purchase	10,00,000
– Sales value of existing machinery	(200,000)
b)	968960
c) Base for Incremental depreciation (a–b)	800,000

(WN-4) : CFAT p.a.

Particulars \ Years	1	2	3	4	5
Profit before Depreciation & Tax	390,000	390,000	390,000	390,000	390,000
– Depreciation	160,000	128000	102400	81920	65536
	(800000 × 20%)	(0.8 × × 160,000 = =)			
EBT	230,000	262000	287600	308080	324464
– Tax @ 30%	(69000)	78600	86280	92424	97339
EAT	161000	183400	201320	215656	227125
+ Depreciation	160,000	128000	102400	81920	65536
	321000	311400	303720	297576	292661

1. Calculation of NPV :

Year	Cash Flow	PVF @ 12%	PV
1	321000	0.893	286653
2	311400	0.797	248186
3	303720	0.712	216249
4	297576	0.636	189258
5	332661	0.567	188619

$$(292661 + 40,000)$$

$$\left(\frac{Scrap}{of \ New} - \frac{Scrap}{of \ Old} \right)$$

$$40,000 - 0$$

PV of Cash Inflow	1128965
PV of Cash Outflow	(800,000)
	328965

Decision:

Since NPV is positive existing machine should be replaced.

46 min   HMR Ltd. is considering replacing a manually

QUESTION 18. (ILLUSTRATION 18)

HMR Ltd. is considering replacing a manually operated old machine with a fully automatic new machine. The old machine had been fully depreciated for tax purpose but has a book value of ₹ 2,40,000 on 31st March . The machine has begun causing problems with breakdowns and it cannot fetch more than ₹ 30,000 if sold in the market at present. It will have no realizable value after 10 years. The company has been offered ₹ 1,00,000 for the old machine as a trade in on the new machine which has a price (before allowance for trade in) of ₹ 4,50,000. The expected life of new machine is 10 years with salvage value of ₹ 35,000.

Further, the company follows straight line depreciation method but for tax purpose, written down value method depreciation @ 7.5% is considering that this is the only machine in the block of assets.

Given below are the expected sales and costs from both old and new machine:

	Old machine (₹)	New machine (₹)
Sales	8,10,000	8,10,000
Material cost	1,80,000	1,26,250
Labour cost	1,35,000	1,10,000
Variable overhead	56,250	47,500
Fixed overhead	90,000	97,500
Depreciation	24,000	41,500
PBT	3,24,750	3,87,250
Tax @ 30%	97,425	1,16,175
PAT	2,27,325	2,71,075

From the above information, ANALYSE whether the old machine should be replaced or not if required rate of return is 10%? Ignore capital gain tax.

PV factors @ 10%:

Year	1	2	3	4	5	6	7	8	9	10
PVF	0.909	0.826	0.751	0.683	0.621	0.564	0.513	0.467	0.424	0.386

Old ⟶ NEW

Tax   A/C
WDV   —   240,000   COST: 450,000
             ignore   Scrap: 35000
                          life: 10 years .

Benefit

                          · Depn
scrap: Exchange   · Tax : WDV @7.5%.
30,000   ✔ 100,000

(WN-1) : cash outflow at begining :

Cost of new machine	450,000
– Benefit from old machine	(100,000)
a) scrap : 30,000	
b) exchange : 100,000	
(Higher of above)	
	350,000

(WN-2) : Profit Before depreciation & Tax.

Particulars	Old machine	New machine	Incremental
PBT	324750	387250	62500
+ Deprecation	24000	41500	17500
	348750	428750	80,000

(WN-3) : Base for Incremental Deprecation :

Particulars		Amt
A) WDV of old machine	(a)	NIL
B) Deprecation base for new machine		
Opening		–
+ Purchase		450,000
– Sale/ Exchange of old machine		(100,000)
	(b)	350,000
c) Base for incremental deprecation	(a-b)	350,000

(WN-4) : CFAT p.a :

Particulars	1	2	3	4	5	6	7	8	9	10
Profit before Deprecation & Tax	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000
–Deprecation	26250	24281	22460	20776	19217	17776	16443	15210	14069	13014
EBT	53750	55719	57540							
– Tax @ 30%	16125	16716	17262							
EAT	37625	39003	40278							
+ Deprecation	26250	24281	22460	20776	19217	17776	16443	15210	14069	13014
	63875	63284	62738	62233	61765	61333	60933	60563	60221	59904

1. Calculation of NPV:

Years	Cash Flow	PVF @10%	PV
1	63875	0.909	58062
2	63284	0.826	52273
3	62738	0.751	47116
4	62233	0.683	42505
5	61765	0.621	38356
6	61333	0.564	34592
7	60933	0.513	31259
8	60563	0.467	28283
9	60221	0.424	25534
10	94904	0.386	36633

60221 59904

(59904 + 35000)

(35000 - 0)

PV of Cash Inflow	394613
PV of Cash Outflow	(3,50,000)
NPV	44613

Decision:
Since NPV is positive old machine should be replaced.

QUESTION 20. (PP 1)

Following data has been available for a capital project:

Annual cash inflows	₹ 1,00,000
Useful life	4 years
Salvage value	0
Internal rate of return	12%
Profitability index	1.064

You are required to CALCULATE the following for this project:

(i)   Cost of project

(ii)   Cost of capital

(iii) Net present value

(iv)   Payback period

PV factors at different rates are given below:

Discount factor	12%	11%	10%	9%
1 year	0.893	0.901	0.909	0.917
2 year	0.797	0.812	0.826	0.842
3 year	0.712	0.731	0.751	0.772
4 year	0.636	0.659	0.683	0.708

1. Cost of Project:

Year	Cash Flow	PVF @ 12%	PV
1-4	100000	3.038	303800

At IRR, PV of cash inflow = PV of cash outflow.

∴ Cost of Project = Rs. 303800.

2. Cost of Capital:

$$\frac{\text{Profitability}}{\text{Index}} = \frac{\text{PV of Cash inflow}}{\text{PV of Cash outflow}}$$

$$1.064 = \frac{\text{PV of Cash inflow}}{303800}$$

∴ PV of cash inflow = 303800 × 1.064 = 323243

Year	Cash Flow	× PVF	=	PV
1-4	100,000	× PVF	=	323243

$$PVF = \frac{323243}{100,000} = 3.232$$

∴ Cost of Capital : 9%.

3. NPV:

PV of Cash Inflow	323243
PV of Cash Outflow	(303800)
	19443

4. Pay-back Period:

$$\frac{\text{Initial Investment}}{\text{Annual CFAT}} = \frac{303800}{100,000} = 3.038 \text{ year.}$$

Capital ——————— Financial ——————— Investment

Cost of   manager

Capital = %   ↓   IRR = %

COST OF   Cash

PROJECT   Inflow.

COST OF   Cash

PROJECT   Inflow

		COC					IRR %	
Year	CF	PVF	PV		Year	CF	PVF	PV
1~4	100,000	③	✓		1~4	12	3.038	303800

PV OF CI	✓	②	1.064	PV OF CI	①		303800
PV OF CO	303800		1	COST = PV OF CO	→		303800
NPV				OF NPV			NIL
				Project			

QUESTION 16. (ILLUSTRATION 16)

The expected cash flows of three projects are given below. The cost of capital is 10 per cent.

(a) CALCULATE the payback period, net present value, internal rate of return and accounting rate of return of each project.

(b) IDENTIFY the rankings of the projects by each of the four methods.

Period	Project A (₹)	Project B (₹)	Project C (₹)
0	(5,000)	(5,000)	(5,000)
1	900	700	2,000
2	900	800	2,000 (4000)
3	900	900	2,000
4	900	1,000	1,000
5	900	1,100 (4500)	
6	900	1,200	
7	900	1,300	
8	900	1,400	
9	900	1,500	
10	900	1,600	

1. Pay-back Period:

Project A: $\dfrac{5000}{900}$ = **5.56 years**.

Project B:

$$5000$$
$$4500$$

5 years + $\dfrac{500}{1206}$

= **5.42 years**

Project C:

$$5000$$
$$4000$$

2 years + $\dfrac{1000}{2000}$

2.5 years.

2. Net Present Value:

Project A:

Year	Cash Flow	PVF @ 10%	PV
1-10	900	6.145	5531
	− PV of Cash outflow		(5000)
			531

Year	PVF @ 10%	Project B PV	Project C PV
1	0.909	636	1818
2	0.826	661	1652
3	0.751	676	1502
4	0.683	683	683
5	0.621	683	-
6	0.564	677	-
7	0.513	667	-
8	0.467	654	-
9	0.424	636	-
10	0.386	618	-
PV of cash inflow		6591	5655
PV of cash outflow		(5000)	(5000)
NPV		1591	655

3. IRR:

Project A:

Year	CFAT	PVF @ 20%	PV
1-10	900	4.192	3773
- PV of cash outflow			(5000)
			(1227)

	20%	Project B		Project C	
Year	PVF	CFAT	PV	CFAT	PV
1	0.833	700	583	2000	1666
2	0.694	800	555	2000	1388
3	0.579	900	521	2000	1158
4	0.482	1000	482	1000	482
5	0.402	1100	442	-	-
6	0.335	1200	402	-	-
7	0.279	1300	363	-	-
8	0.233	1400	326	-	-
9	0.194	1500	291	-	-
10	0.162	1600	259	-	-
PV of cash inflow			4224		4694
- PV of cash outflow			(5000)		(5000)
NPV			(776)		(306)

$$IRA = \frac{Lower}{Rate} + \frac{Positive\ NPV}{\Delta\ NPV} \times \Delta\ Rate$$

Project A $= 10 + \dfrac{531}{531-(1227)} \times (20-10)$

$10 + \dfrac{531}{1758} \times 10$

$= 10 + 3.02$

$= 13.02\%$

Project B $= 10 + \dfrac{1591}{1591-(776)} \times (20-10)$

$= 10 + \dfrac{1591}{2367} \times 10$

$= 10 + 6.72$

$= 16.72\%$

Project C $= 10 + \dfrac{655}{655-(306)} \times (20-10)$

$= 10 + \dfrac{655}{961} \times 10$

$= 10 + 6.82$

$= 16.82\%$

---

4. Accounting (Avg) Rate of Return (ARR):

Particulars	A	B	C
1. Average Accounting Profit: $\dfrac{Total\ Inflow - Total\ outflow}{No\ of\ years.}$	$\dfrac{9000-5000}{10}$ = 400	$\dfrac{11500-5000}{10}$ = 650	$\dfrac{7000-5000}{4}$ = 500
2. Average Investment: $\dfrac{Initial + Scrap.\ Invt}{2}$	$\dfrac{5000}{2}$ 2500	$\dfrac{5000}{2}$ 2500	$\dfrac{5000}{2}$ 2500
3. Accounting Rate of Return. $\dfrac{Avg\ Atcg\ Profit}{Avg\ Invt}$	$\dfrac{400}{2500} \times 100$ = 16%	$\dfrac{650}{2500} \times 100$ = 26%	$\dfrac{500}{2500} \times 100$ = 20%

QUESTION 6. (ILLUSTRATION 6)

A Ltd. is evaluating a project involving an outlay of ₹ 10,00,000 resulting in an annual cash inflow of ₹ 2,50,000 for 6 years. Assuming salvage value of the project is zero; DETERMINE the IRR of the project.

Calculation of IRR:

Year	Cash Flow	PVF@12%	PV	PVF@13%	PV
1-6	2,50,000	4.111	1027750	3.998	999500
			(10,00,000)		(10,00,000)
			27750		(500)

$$IRR = 12 + \frac{27750}{27750 + 500} \times (13-12)$$

$$\left(\begin{array}{cc} 1\% & 28250 \\ ? & 27750 \end{array} \right)$$

$$= 12 + 0.98$$

$$= \boxed{12.98}$$

CALCULATE the internal rate of return of

QUESTION 7. (ILLUSTRATION 7)

CALCULATE the internal rate of return of an investment of ₹ 1,36,000 which yields the following cash inflows:

Year	Cash Inflows (₹)
1	30,000
2	40,000
3	60,000
4	30,000
5	20,000

1. Calculation of IRR:

Year	Cash Flow	PVF@10%	PV	PVF@12%	PV
1	30,000	0.909	27270	0.893	26790
2	40,000	0.826	33040	0.797	31880
3	60,000	0.751	45060	0.712	42720
4	30,000	0.683	20490	0.636	19080
5	20,000	0.621	12420	0.567	11340
			138280		131810
			(136000)		(136000)
			2280		(4190)

$$IRR = 10\% + \frac{2280}{2280 + 4190} \times (12-10) \qquad \left(\begin{array}{c} 2\% \\ ? \end{array} \times \begin{array}{c} 6470 \\ 2280 \end{array} \right)$$

$$= 10 + 0.70$$

$$= 10.70 .$$

QUESTION 8. (ILLUSTRATION 8)

A company proposes to install machine involving a capital cost of ₹ 3,60,000. The life of the machine is 5 years and its salvage value at the end of the life is nil. The machine will produce the net operating income after depreciation of ₹ 68,000 per annum. The company's tax rate is 45%. The Net Present Value factors for 5 years are as under:

Discounting rate	14	15	16	17	18
Cumulative factor	3.43	3.35	3.27	3.20	3.13

You are required to COMPUTE the internal rate of return of the proposal.

(WN-1): CFAT p.a.

PBT	68000
– Tax @ 45%	(30600)
PAT	37400
+ Depreciation (360,000 ÷ 5)	72000
	109400

Calculation of IRR:

Year	Cash flow	PVF @ 15%	PV	PVF @ 16%	PV
1–5	109400	3.35	366490	3.27	357738
			(360,000)		(360,000)
			6490		(2262)

$$IRR = 15 + \frac{6490}{6490 + 2262} \times (16-15)$$

$$= 15 + 0.74$$

$$= 15.74$$

QUESTION 22. (PP 3)

Hindlever Company is considering a new product line to supplement its range of products. It is anticipated that the new product line will involve cash investments of ₹ 7,00,000 at time 0 and ₹ 10,00,000 in year 1. After-tax cash inflows of ₹ 2,50,000 are expected in year 2, ₹ 3,00,000 in year 3, ₹ 3,50,000 in year 4 and ₹ 4,00,000 each year thereafter through year 10. Although the product line might be viable even after year 10, the company prefers to be conservative and end all calculations at that time.

(a)   If the required rate of return is 15 per cent, COMPUTE net present value of the project. Is it acceptable?

(b)   ANALYSE what would be the case if the required rate of return were 10 per cent.

(c)   CALCULATE its internal rate of return.

(d)   COMPUTE the project's payback period.

a&b) Evaluation of Project:

Calculation of NPV

Year	Cash Flow	PVF @ 15%	PV	PVF @ 10%	PV
0	(700,000)	1	(700,000)	1	(700,000)
1	(10,00,000)	0.870	(870,000)	0.909	(909000)
2	2,50,000	0.756	189000	0.826	206500
3	300,000	0.658	197400	0.751	225300
4	350,000	0.572	200200	0.683	239050
5-10	400,000	2.164	865600	2.975	1190,000

$$\frac{1}{1.15} = \begin{array}{l} = m+ \\ = m+ \\ = m+ \\ = m+ \end{array} \quad \begin{array}{l} = m+ \\ = m+ \\ = m+ \\ MRC \end{array}$$

NPV.   (117800)   251850.

- If required rate of return is 15%
  then Project shall be rejected as NPV is negative.

- If required rate of return is 10%
  then Project shall be accepted as NPV is positive.

c) IRR = 10 + $\dfrac{251850}{251850 + 117800}$ × (15-10)

10 + 3.41

13.41

d) Pay-back Period:

year	CFAT	cumulative
2	250,000	250,000
3	300,000	550,000
4	350,000	900,000
5	400,000	1300,000
6	400,000	1700,000

Investment in Project: 700,000 + 10,00,000 = 1700,000

∴ Pay-back period = 6 years.

Capital Rationing

Company has limited capital (say : 60L)

2 Projects are under consideration

Divisible Project	Non-Divisible Project
• Part of the project can be accepted	• Either entire project is accepted or rejected.
• Building cost 10 floors = 100L	• Sealink cost 10 km = 100 L
• Project upto 6 floors can accepted.	• Entire project will be rejected.

QUESTION 13. (ILLUSTRATION 13)

Shiva Limited is planning its capital investment programme for next year. It has five projects all of which give a positive NPV at the company cut-off rate of 15 percent, the investment outflows and present values being as follows:

Project	Investment (₹)	NPV @ 15% (₹)
A	(50,000)	15,400
B	(40,000)	18,700
C	(25,000)	10,100
D	(30,000)	11,200
E	(35,000)	19,300

The company is limited to a capital spending of ₹ 1,20,000.

You are required to ILLUSTRATE the returns from a package of projects within the capital spending limit. The projects are independent of each other and are divisible (i.e., part- project is possible).

1. Ranking based on per ₹. 1 of investment:

Project	(a) Investment	(b) NPV	NPV per ₹1 invested. (b/a)	Ranking
A	50,000	15400	0.31	5
B	40,000	18700	0.47	2
C	25000	10100	0.40	3
D	30,000	11200	0.37	4
E	35000	19300	0.55	1

2. Investment based on Ranking: (Divisible)

Project	Investment	Cumulative	NPV
E	35000	35000	19300
B	40,000	75000	18700
C	25000	100,000	10100
D	20,000	120,000	7467

$$\left(\frac{30,000}{20,000} \times \frac{11200}{?} \right)$$

| | 1,20,000 | | 55567 |

$\therefore$ Project E, B & C will be fully accepted.

Project D will be partly accepted. $\left(\frac{20,000}{30,000} \times 100 = 66.67\% \right)$

Project A will be fully rejected.

* IF projects are non-divisible:

Option 1				Option 2		
Project	Investment	NPV		Project	Investment	NPV
E	35000	19300		E	35000	19300
B	40,000	18700		B	40,000	18700
C	25000	10100		D	30,000	11200
	100,000	48100			105000	49200

∴ Project E, B & D will be fully accepted
Project A & C will be fully rejected.

Extra:

Investment Available : 1,20,000
Investment in E & B.   75000
                          45000

	A	C	D
NPV	x	10100	11200
	(Inv = 50,000)		

QUESTION 15. (ILLUSTRATION 15)

Alpha Company is considering the following investment projects:

Projects	Cash Flows (₹)			
	C_0	C_1	C_2	C_3
A	–10,000	+10,000		
B	–10,000	+7,500	+7,500	
C	–10,000	+2,000	+4,000	+12,000
D	–10,000	+10,000	+3,000	+3,000

(a) ANALYSE and rank the projects according to each of the following methods: (i) Payback, (ii) ARR, (iii) IRR and (iv) NPV, assuming discount rates of 10 and 30 per cent.

(b) Assuming the projects are independent, which one should be accepted? If the projects are mutually exclusive, IDENTIFY which project is the best?

a) 1) Pay-back period :

Project A = $\dfrac{10,000}{10,000}$ = 1 year.

Project B = $\dfrac{10,000}{7500}$ = 1.33 years

Project C =   2 years + $\dfrac{4000}{12000}$

= 2.33 years

Project D = 1 year.

(ii) ARR:

Particulars	A	B	C	D
a) Avg Profit: $\left(\frac{\text{Inflow} - \text{Outflow}}{\text{No of years}}\right)$	– (10,000-10,000)	2500 $\left(\frac{15000-10000}{2}\right)$	2667 $\left(\frac{18000-10,000}{3}\right)$	2000 $\left(\frac{16000-10,000}{3}\right)$
b) Avg Investment $\left(\frac{\text{Invt} + \text{scrap}}{2}\right)$	–	5000 $\left(\frac{10,000}{2}\right)$	5000 $\left(\frac{10,000}{2}\right)$	5000 $\left(\frac{10,000}{2}\right)$
c) ARR: $(a \div b) \times 100$	–	50%	53.34%	40%

(iii) NPV:

a) NPV at 10%

Years	PVF@10%	A CFAT	A PV	B CFAT	B PV	C CFAT	C PV	D CFAT	D PV
1	0.909	10,000	9090	7500	6818	2000	1818	10,000	9090
2	0.826	–		7500	6195	4000	3304	3000	2478
3	0.751	–				12000	9012	3000	2253
			9090		13013		14134		13821
			(10,000)		(10,000)		(10,000)		(10,000)
NPV			(910)		3013		4134		3821

b) NPV at 30%

Years	PVF@30%	A CFAT	A PV	B CFAT	B PV	C CFAT	C PV	D CFAT	D PV
1	0.769	10,000	7690	7500	5768	2000	1538	10,000	7690
2	0.592	–		7500	4440	4000	2368	3000	1776
3	0.455	–				12000	5460	3000	1365
			7690		10208		9366		10831
			(10,000)		(10,000)		(10,000)		(10,000)
NPV			(2310)		208		(634)		831

iv) IRR:

Project A: NIL

Project B: $30 + \dfrac{208}{2805} \times 20$

% :	10%	30%		IRR
NPV :	3013	208		0

20 ?

2805   208

$= 30 + 1.48$

$= 31.48$.

"OR"

$10 + \dfrac{3013}{2805} \times 20$

$= 10 + 21.48$

$= 31.48$.

Project C: $10 + \dfrac{4134}{4134 + 634} \times (30 - 10)$

$= 10 + 17.34$

$= 27.34$.

Project D: $10 + \dfrac{3821}{3821 - 831} \times (30 - 10)$

$= 10 + 25.56$

$= 35.56\%$
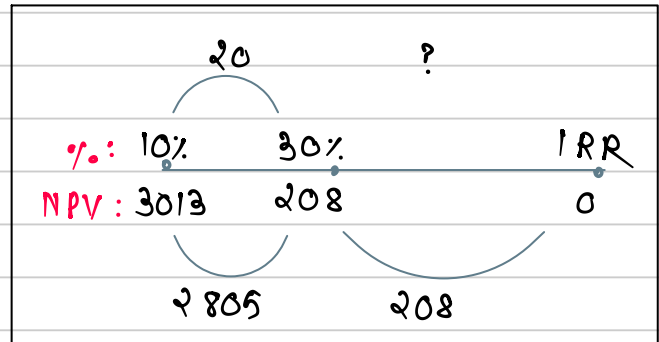
* Ranking:

Par	A	B	C	D
↓ a) PBP (Years)	1	1.33	2.33	1
Ranking	1	2	3	1
↑ b) ARR (%)	0%	50%	53.33%	40%
Ranking	4	2	1	3
↑ c) IRR (r)	—	31.48%	27.34%	35.56%
Ranking	4	2	3	1
↑ d) NPV (10%)	(910)	3013	4134	3821
Ranking	4	3	1	2
↑ e) NPV (30%)	(2310)	208	(634)	821
Ranking	4	2	3	1

QUESTION 14. (ILLUSTRATION 14)

R Pvt. Ltd. is considering modernizing its production facilities and it has two proposals under consideration. The expected cash flows associated with these projects and their NPV as per discounting rate of 12% and IRR is as follows:

Year	Cash Flow	
	Project A (₹)	Project B (₹)
0	(40,00,000)	(20,00,000)
1	8,00,000	7,00,000
2	14,00,000	13,00,000
3	13,00,000	12,00,000
4	12,00,000	0
5	11,00,000	0
6	10,00,000	0
NPV @12%	6,49,094	5,15,488
IRR	17.47%	25.20%

IDENTIFY which project should R Pvt. Ltd. accept?

METHOD 1: Equivalent Annualised Return:

Par	A	B
NPV at 12%	649094	515488
÷ PVF at 12%	4.111	2.402
	(12%, 6 years)	(12%, 3 years)
	157892	₹ 14608

Project B should be accepted.

METHOD 2: Replacement chain: It is assumed that at the end of Y3 we will buy new machine

Year	CFAT	PVF @12%	PV	
0	(2000000)	1	(20,00,000)	1 7L ×
1	700000	0.893	625100	2 13L ×
2	1300,000	0.797	1036100	3 12L ×
3	(800000)	0.712	(569600)	4 7L ×
	(1200000 –2000000)			5 13L ×
4	700000	0.636	445200	6 12L ×
5	1300,000	0.567	737100	PV of CI
6	1200,000	0.507	608400	PV of CO
	NPV:		882300	Y0: 20(x)1
				Y3: 20(x0%12

QUESTION 9. (ILLUSTRATION 9)

An investment of ₹ 1,36,000 yields the following cash inflows (profits before depreciation but after tax). DETERMINE MIRR considering 8% as cost of capital.

Year	(₹)
1	30,000
2	40,000
3	60,000
4	30,000
5	20,000
	1,80,000

EXTRA –

Y0   Y1   Y2   Y3   Y4   Y5

(136000)   30,000   40,000   60,000   30,000   20,000

Y5: 20,000

+8%   Y4: 32400

+ 8%   +8%   Y3: 69984

+ 8%   +8%   +8%   Y2: 50388

+8%   +8%   +8%   +8%   Y1: 40815

Inflow at Y5: 213587

Outflow at Y0 : 136000

M. IRR
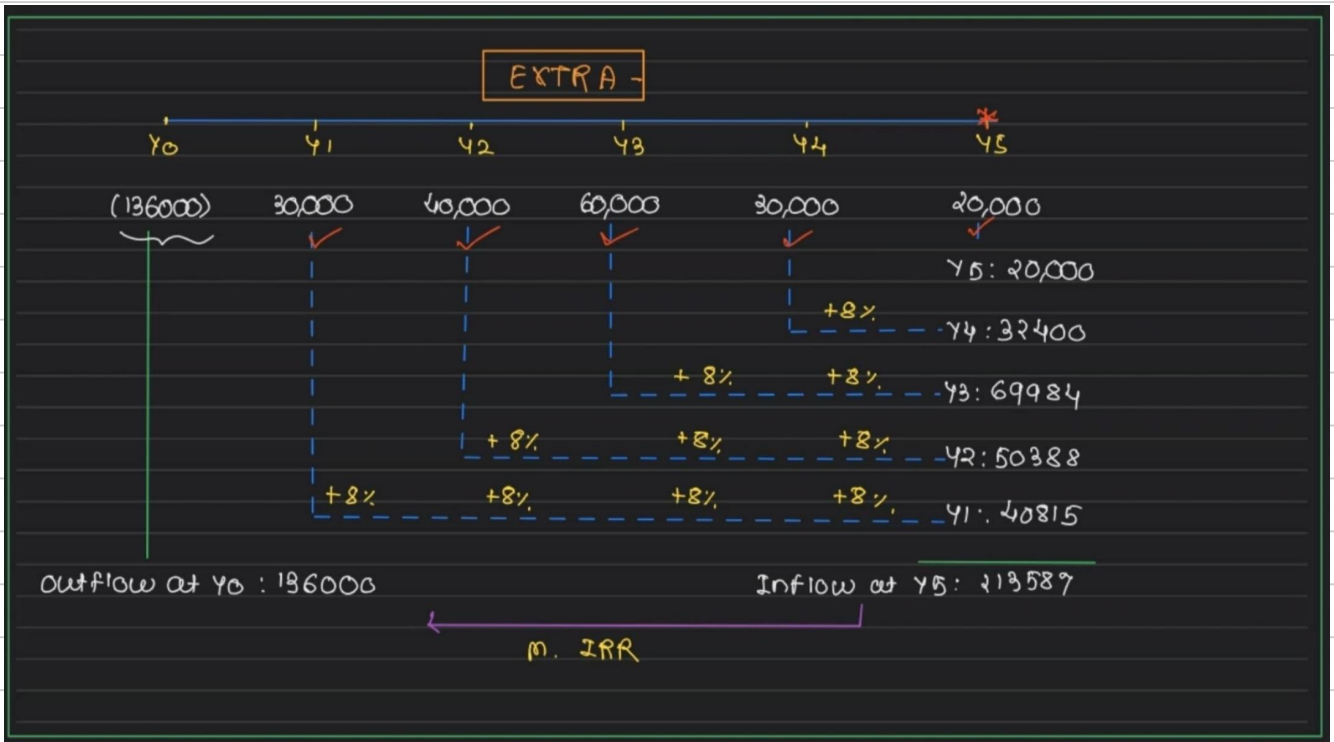
Modified IRR:

Year	CFAT	@8% Re-investment	CF at 5th year.
1	30,000	4 years	40815
2	40,000	3 years	50388
3	60,000	2 years	69984
4	30,000	1 year	32400
5	20,000	0	20,000
		CF at 5th year.	213587

NPV

		10%		8%	
Year	CFAT	PVF	PV	PVF	PV
5	213587	0.621	132638	0.681	145453
			(136000)		(136000)
			(3362)		9453

$$\text{Modified IRR} = 8 + \frac{9453}{9453 - (3362)} \times (10 - 8)$$

$$= 8 + \frac{9453}{12815} \times 2$$

$$= 8 + 1.48$$

$$= 9.48\%$$

$$\sqrt{\frac{\text{In FV}}{\text{Out}}} \quad 12 \text{ times} \quad -1 \quad \times \frac{1}{5} \quad +1$$

$$\text{years}$$

$$X = 12 \text{ times}$$

$$\frac{213587}{136000} = \sqrt[12 \text{ times}]{\quad} \quad -1 \quad \times \frac{1}{5} \quad +1 \quad X = 12 \text{ times}$$

$$\text{years}$$

QUESTION 2. (ILLUSTRATION 2)

A project requiring an investment of ₹ 10,00,000 and it yields profit after tax and depreciation which is as follows:

Years	Profit after tax and depreciation (₹)
1	50,000
2	75,000
3	1,25,000
4	1,30,000
5	80,000
Total	4,60,000

Suppose further that at the end of the 5th year, the plant and machinery of the project can be sold for ₹ 80,000. DETERMINE Average Rate of Return.

ARR

Based on Initial Invt

a) Average Return: (PAT)
4,60,000 ÷ 5 years
= 92000

b) Initial Invt:
10,00,000

c) ARR:
$\frac{92000}{10,00,000} \times 100$

= 9.2%

Based on Avg Invt.

a) Average Return: (PAT)
4,60,000 ÷ 5 years
= 92000

b) Average Invt:
$\left\{ \frac{\text{Initial Invt} + \text{Scrap}}{2} \right\} + \text{working capital}$

$\left\{ \frac{10,00,000 + 80,000}{2} \right\} + \text{NIL}$

= 5,40,000

c) ARR:
$\frac{92000}{5,40,000} \times 100$

17.04%